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The Agricultural Geography of the Madura District

By

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The treatment of agricultural activities and distribution of crops on a scientific basis has become an important branch of investigation in recent years. It forms a fruitful line of research in several University Schools of Geography in the West, especially in the United States of America. It is particularly helpful in the case of our country, a country whose vast peasant population depends for its maintenance and well-being on factors which influence this most ancient and the most important of all the human occupations viz. the agricultural industry. This ancient industry of ours is, and for many years to come must remain, India's greatest industry, providing occupation directly and indirectly for the great majority of the population of this country.

"The study of the agricultural geography of the Madura District is the study of the basis of the practice of all life in the district." The sons of the district are the tillers of the land, living on the returns it gives them for their honest labours. This is only a portion of the picture of India as a whole.

It is the aim of this paper to study how the land of the Madura District fulfils its obligations to its cultivators. "Firstly to analyse the physical basis of the region, its soil and its climate as determining its productive power and to survey the production of this region in view of these factors," next to show the importance of

the human factor that plays not a little part in determining the productive power of this district.

The Madura District is bounded on the north by Coimbatore and Trichinopoly Districts, on the east by Trichinopoly and Ramnad Districts, on the south by Ramnad and Travancore and on the west by Travancore and Coimbatore Districts. It is divided into seven Taluks; namely, Madura, Tirumangalam, Melur, Dindigul, Periyakulam, Palni and Nilakottai.

It is necessary to know first the general features of the district. The most important of them, that stands out prominently, is the section of the plain that stretches from the eastern slopes of the Western Ghats to the sea, broken in the west by several spurs from the Ghats and a few isolated hills and masses of rock that are scattered over the country. The Palni or the Varaha mountains is the most important spur, projecting in a N. E. direction across the district for about fifty miles. Their highest peaks are more than 8,000 feet, enclosing a plateau of over 100 sq. miles with an average height of 7,000 feet. They can be usefully divided for convenience's sake into Higher and Lower Palnis. The former lying to the west, have grass-topped hills and have an abundant supply of water throughout the year. The latter are much lower, sloping gradually towards the plains until the hills grade into them at a height of about 1,000 feet. Next in importance is the spur known as Varshanad or Andipatti range running N. E. from the Western Ghats for a distance of about 40 miles. On the south, this shuts in the upper portion of the Vaigai Valley, then turns suddenly to S. E. and sinks into the plain not far west of Madura. A greater portion of the district is covered by hills. These hills are generally wild and uncultivated besides being rocky and clothed with scantiest cultivation. Then we notice N. E. of the Palni range an irregular congeries of hills known as Sirumalais, Karunthamalais, the Nattam and the Alagar hills. These hills, which fill up a large portion of Madura, Melur and Dindigul Taluks, are rather low and sterile; and the malignant fever which lurks on their slopes prevents them from being habitable. The Sirumalais are the only considerable and lofty mass, having an extreme length of 20 miles and are between 3,500 and 4,000 feet in height.

The main rivers of the district are the Vaigai, the Varashalai and the Gundu, of which the Vaigai is the most important. It

rises in the Western Ghats and flows at first N. E. between the Palni and Andipatti ranges. Then turning S. E., it flows past Madura to the sea in the Palk passage. The one chief characteristic of the rivers of this district is that they are uncertain in their flow and they are rarely in freshes for more than a few days at a time.

As observed above, the physical factors that determine the production of the region under survey are soils and climate. I am aware that specialists are contributing papers on the subjects of climate and rainfall, soil, cattle and the people of the district and if I make any reference to these subjects again it is only with a view to show how far they determine the productive capacity of this region.

Geology. A knowledge of the main features of the geological structure of this district is quite essential in connection with the study of its agricultural geography. For geological structure not only influences the features of the country but also controls the nature of the soils and the farming carried thereon. In a general way the soil is mostly the decomposed top of the rock, more or less unwashed in the case of fertile fields, or else formed altogether of deposited washings, as in the case of alluvial meadows. Again the chemical composition of soils depends much on the rock underlying it.

The geology of Madura is rather simple and somewhat uninteresting compared with the districts of Trichinopoly and Tinnevelly. *The predominant geological formation of the district is granite, which underlies the whole area.* A gravelly bed of laterite which is quarried for building purposes runs through the eastern parts of the district from north to south. The following geological groups are some of the most important ones that are found in the district: lower granitoid gneiss (Tirumangalam), lower granular quartz rock (Kokkulam group), middle and upper granitoid gneiss (Skandamalai and Melur groups respectively).

Soil. Next we shall pass on to consider for a while the nature and fertility or otherwise of the soil of the Madura District. The nature of the soil is generally due to geological origin and its physical characteristics have much to do with farming. The ordinary constitutions of the soil are sand, clay, lime, humus and gravel and the ordinary texture and nature of the soil depend on their

relative proportion. From these the farmer ordinarily judges the arable qualities of the land. Where any one predominates in the soil, it takes its name from the same. Sometimes there are any number of intermediary varieties, e.g. loam (sand and clay), marl (clay and lime-stone).

With these few general remarks on soil let us consider in detail the nature and the relative productivity of the different soil types of the Madura District. It is however useful to note that the degree of soil productivity is not determined solely by the soil itself as factors of climate and position also play a very large part. A soil may be of first class productivity under some climatic conditions and the same may be quite useless under others. Thus in the words of Miss Simkins "a study of soils in relation to production necessitates the correlation of climate and topographical factors with soil types."

The prevailing soil in the district belongs principally to the red ferruginous series, though black regur variety is not entirely absent. In the Tirumangalam Taluk the proportion of black cotton soil is considerable; and there is a great difference between this soil and that of the Deccan. The former is more friable, less retentive of moisture and more suited to irrigation, which is being carried on from tanks and wells. The total extent of black regur series in the district is somewhere about 200,000 acres, (both dry and wet) which is 15% of the total. Of this Tirumangalam alone has about 132,000 acres (both dry and wet), which is nearly 61% of the soil in the taluk. The red ferruginous series predominate to the extent of 85% of the soil in the district, which is about 1,122,000 acres. It is interesting to note that the taluk of Melur is covered entirely with red soil (nearly 180,000 acres). According to the Resurvey and Resettlement of the whole district the area covered by the black clay loam and sand is 195,000 acres, which is 14.90% of the total and that of the red loam and sand is about 1,111,000 acres which is 85.10% of the total. (The above figures have been taken from the table in the Statistical Atlas 1924, showing the classification of the soil in regard to occupied and unoccupied area in all the Government Taluks of the district and in regard to the occupied area alone in the Kodaikanal Taluk.).

The soil is somewhat fine and sufficiently deep at places. The chemical composition of the soil is really better than that of most of the other districts in the Presidency. Cereals do not seem to

be very popular on the red ferruginous soil; but the black regur series yield a considerable variety of good crops, provided there is sufficient rainfall and the ryots are fairly efficient. Like Coimbatore, Madura has a large area under dry cultivation, which is less expensive than wet cultivation. The red and black loam have remarkably high productive capacity.

Climate. Climate is the other important physical factor which determines the productivity of this district. The climate of Madura is not by itself quite encouraging for the pursuit of agricultural activities. Madura like Coimbatore is one of the driest districts of the Presidency receiving 31·4 inches (average for 50 years ending 1930) and the actual fall in 1930-31 is 38·7″ by both S. W. and N. E. monsoons. It is slightly better than Tinnevelly which receives 29·0″ (average for 50 years ending 1930). Moreover, the supply of rainfall is rather irregular and the distribution varies in the different parts of the district. The following table gives us an idea of the seasonal distribution:

	Av. for 50 years	1930-31
Hot weather: 1st Feb. to 6th June	6·3″	4·9″
S. W. Monsoon: 7th June to 27th Sept.	9·0″	6·2″
N. E. Monsoon: 28th Sept. to 31st Jan.	16·1″	27·6″
Total rainfall for the district:		
Average for 50 years		31·4″
1930-31		38·7″

Slightly less than a quarter of the rainfall is received from the S. W. Monsoon and more than half by the N. E. Monsoon. The average number of wet days per year is 60·4 and the quantity of rainfall per shower is a little above 3/5″. As the predominating soil of the district is red sand, which is incapable of retaining moisture for any length of time, so little a fall, viz., only a fraction of an inch is not of much practical use except for ploughing, as it is hardly enough to fill up tanks in a country which contains much porous soils.

Certain taluks, being more hilly and elevated than others, receive much more than the average rain; but these taluks are not agriculturally the most prosperous. Moreover, many of the villages at the foot of the hills are still fever-ridden; and a considerable percentage of arable area in these taluks is not taken up for cultivation. In the west of the taluks the pressure of population

is so heavy that intensive soil cultivation has been resorted to. The rainfall is lowest in Palni, Dindigal and Periakulam, and heaviest in Madura and Melur Taluks. The difference occurs entirely in the supply registered during the S. W. Monsoon. The main cause of the difference is that these three taluks with the lowest rainfall are close under the highest portions of the Western Ghats. So they do not get the benefit of the moisture brought by the S. W. Monsoon, while Madura and Melur stand farther away from the shelter of these hills. For this reason Palni and Dindigal depend on wells for the maturity of crops instead of being at the mercy of the seasons. The average fall during the S. W. Monsoon in the district is smaller than in any other district except in Tinnevelly, while all the taluks share equally in the rains brought by the N. E. Monsoon.

The months of July to November are the busiest months as regards the sowing of crops. If there is sufficient seasonable rainfall in March, April and May, the ryots will be helped to plough and prepare their dry land and to plant out paddy for the early or short crop called the "Adikodi" to be harvested in July or August. Then, rain is very essential in August and September for helping the proper maturity of dry crops and also for the necessary preparation of the ground for sowing of the principal "Kalam paddy" crop. After the N. E. Monsoon a few showers in December and January serve to refresh such dry crops as may yet be standing. If those showers are somewhat heavy, another crop called "Masikodi" is sown and the ryot looks forward eagerly for one or two showers to protect this crop. Thus it is quite evident that for a first rate season, there should, therefore, be rain in almost every month of the year.

Temperature Conditions. The range of temperature in the Madura District is rather great (from 59·2 to 105·50). The maximum, minimum and mean average figures are 94·0 degrees, 73·9 degrees, and 83·9 degrees respectively. April, May, June and July are the hottest months of the year. The annual mean temperature of Madura is 4 degrees higher than that of Coimbatore; compared to Trichinopoly and Tinnevelly Districts, Madura is found to be a degree or two cooler than the latter but slightly hotter than the former in the four months, November to February. In November December and January the mean temperature is below 80 degrees. Dindigal is generally cooler than Madura. The heat in the Cum-

bam Valley during the S. W. Monsoon is reduced by the pleasant breeze which blows down to it from the hills. The annual mean humidity of Madura (70·2 degrees) is slightly less than that of Tinnevelly and rather higher than that of Trichinopoly. Thus the climate of Madura District is hot, dry, and variable. There is no regular cold season and only a little amount of rainfall is distributed over the greater part of the year.

Irrigation. Irrigation, as in other districts, has played an important part in the development of agriculture in the district. There are important tracts in the district irrigated by channels from the Vaigai and its tributaries. The district cannot boast of any perennial rivers of any importance. After the completion of the Periar project, the best irrigation sources are the Vaigai and its tributaries, the Suruli and Varahanadi. These are equal to the second best irrigation sources in the Tinnevelly district. Before the Periar project, the taluks of Nilakkottai and Melur were the worst in respect of irrigation as there were no rivers or river channels of any magnitude. The Periar project has contributed a great deal to the improvement of the condition of the taluk of Melur. This great project was brought into operation in 1896-97 and it is the main cause of the increase in the irrigated areas in the taluks of Madura, Melur, Nilakkottai and Periakulam. According to the Statistical Atlas (1924), Dindigal taluk stands first in having the largest number of wells; and those in the Palni Taluk are the most efficient in the district. Many wells in the taluks of Madura and Melur have been abandoned since the Periar project came into operation. According to the same authority, the total area irrigated in the district by tanks, channels, wells, and Turavus protected in all seasons is a little over 310,000 acres. Irrigation by tanks and channels is largely carried on in Madura and Melur Taluks (86·7% and 52·8% of area cultivated respectively). Out of a total area of a little over 90,000 acres under well irrigation, Palni and Dindigal Taluks contribute roughly 33,000 and 26,000 acres respectively, where the major part of irrigation is promoted by well. Periakulam and Tirumangalam Taluks come next in order. Loans were advanced under the Land Improvement Loans Act by a special staff to construct new wells and to repair old ones. But according to the recent season and crop report (1930-31) more land has come under irrigation. The total area under irrigation in the district from Government channels, private channels, tanks,

wells having independent ayacuts and wells supplementing recognised sources of irrigation, and spring channels is roughly 443,000 acres; this area is slightly above that of Ramnad and a little below that of Coimbatore. The following main crops are under irrigation in the district, Paddy, Cholam, Ragi, Cotton (Cambodia), Cumbu, Pulses, Groundnut, Gingelly, Sugarcane and Castor. The crops are given in their order of importance. The percentage of irrigated area to net area sown is 36 per cent. and that of area irrigated by wells to the total area irrigated is 36%. It is comforting to know that some fields under irrigation bear two or even three crops per year; and thus these sustain a very large population.

Forests. In the Madura District forests occupy nearly 13% of the total area i.e., roughly 416,000 acres (Season and Crop Report 1930-31). This proportion is just the average for the Presidency but it is the largest in the Southern Districts, Tinnevelly having only 10% coming next in importance.

The importance of forests in an agricultural district like Madura can hardly be over-stressed. "Forestry is indeed the handmaid of agriculture." The advantages of forests to the agricultural community of this district are many. We may in passing mention a few of the most important ones. The Madura ryot gets his green manure, fuel for home consumption, thus helping him to conserve (the best of all manures) the farmyard manure, wood for his agricultural implements and vast stretches of grazing grounds for his cattle. Nor should we fail to point out the intangible benefits to the agriculture of this district derived from forests, which are hy no means less important. They act as excellent conservers of moisture, besides regulating the flow of rain water into rivers and tanks, thus preventing erosion of soil and sudden floods.

As we have noted above forests afford excellent grazing grounds for cattle; but it should be noted, however, that, unlike in the district of Coimbatore which is very famous for excellent breeds of cattle, in the district of Madura cattle-breeding is not carried to any appreciable extent in any of the taluks. Periakulam and Melur alone of all the taluks in the district afford greater facilities for cattle-breeding. According to Mr. Sampson the Cumbam Valley cattle in the Periakulam Taluk are quite familiar to the ryot, and in the Melur Taluk the Kallars have taken to cattle-breeding. Thus we see the gradual rise of the cattle-breeding industry in

these localities. Generally the quality of the cattle of this district is below average and in recent years Madura has become the southern market for Coimbatore breeds especially for draught purposes.

Crops. Let us now pass on to the study of the crops raised in this district. A careful study of the crop figures relating to this district in the latest Season and Crop Report (1930-31) of the Madras Presidency indicates some highly interesting features. In the first place, one is struck by the great diversity of crops raised in this district. Some of the most important ones are Paddy, Cumbu, Ragi, Varahu, Samai, all the important pulses (green, red, black, Bengal, horse grams), almost all condiments and spices, sugarcane, groundnut, gingelly, castor, cocoanut, cotton and other fibres, tobacco and other narcotic drugs, fodder-crops, fruits and vegetables (including root crops). The quality of some of these crops is really above average. It is of great interest to note the relative position of this district in the Presidency in respect of the important crops.

The thing that catches our eye is that Paddy, "the most ubiquitous crop in the Presidency" occupies the largest area under cultivation in the district. It is nearly 340,000 acres compared with the 365,000 acres of Tinnevelly District, while that of the Tanjore District is three times that of the Madura District, i.e., a little over 1 million acres. This high acreage under paddy shows that the soil and the climate of this district are quite propitious to paddy. In the taluks of Madura, Melur, Periakulam and Nilakkottai, the area under paddy is large. It has in fact occupied nearly two-third of the acreage under paddy, that is, 258,000 acres. This is largely due to irrigation from Periar project. It is generally a rotation crop raised on the black cotton soil; and it is not too much to say that the value of this crop for man and beast is really inestimable. The area under Cumbu is only a fourth of that under Cholam (61,000 acres). Salem which has the largest acreage under Cumbu (394,000) in the Presidency has 6 times that of Madura, whereas Trichinopoly has an area which is 4½ times that of Madura (272,000). Ragi covers roughly 62,000 acres; and only 10 districts have larger areas in the Presidency. Vizagapatam has the largest and the West Godavari District has the lowest acreage, excluding Nilgiris which has only 2,500 acres. Among the southern districts, Madura has the largest.

Just a word about the nutritious value of these important dry crops. It has been proved beyond doubt that these are more nutritious than rice; and it is highly gratifying to see that these enter freely into the dietary of the peasants of Madura. As Mr. K. C. Ramakrishnan has observed in his valuable paper on the Agricultural Geography of Coimbatore District year before last, there is also the deplorable tendency in recent times, among the middle class, which is comparatively well-to-do, to use polished rice for the sake of prestige; and it is needless to say that medical men have given enough warning about the dangers of such a practice.

After the food grains, let us consider for a while the money crops of this district. There is a fairly decent acreage under Chillies, i.e., roughly 10,000 acres. Guntur has the largest in the Presidency, roughly 71,000; and among the southern districts Tinnevelly has the largest, a little less than 27,000 acres. Tobacco, which is a short duration money crop compared to Sugar and Cotton, is a highly paying crop. The area under tobacco in the district of Madura is a little less than 12,000 acres. Guntur, again as in the case of Chillies, is the greatest tobacco producing district in the Presidency. Madura is nearly second to Coimbatore among the Tamil Districts. The latter has a little over 41,000 acres under tobacco. Generally tobacco thrives on calcareous soil and brackish water containing some soluble salts; and requires the careful and regulated use of well water. Both Chillies and Tobacco are grown in a few favoured spots as in Coimbatore. The area under tobacco is large in Palni, Periakulam, and Dindigal. Messrs. Spencer & Co's Cigar Factory at Dindigal has a great demand for the tobacco produced in the district.

The major money crop of the district is cotton. Roughly 138,000 acres are under Cotton (both irrigated and unirrigated). Bellary is the greatest Cotton producing district in the Presidency. Among the southern districts Tinnevelly and Ramnad exceed Madura in the production of Cotton. The famous Cambodia cotton introduced a quarter of a century back is grown under irrigated and unirrigated conditions. The Cambodia Cotton has a fairly long staple and is in great demand by mills spinning 40 and more counts. Nearly 50% of the area under Cotton is in the Tirumangalam Taluk and the other Taluks in order are Dindigal, Periakulam and Palni. The Cotton raised in the district is mostly ginned at Virudupatti Ramnad District and is in great demand by the Madura Mills themselves. The local weavers consume a

large portion of the yarn produced in these mills. This district is gradually being industrialised; and is dotted with a number of ginning and spinning and weaving mills. The agricultural workers, who are under-employed or unemployed get seasonal and permanent work in these factories.

Ground-nut occupies a little over 101,000 acres in this district (1930-31), whereas a normal is only 80,000 acres. South Arcot and North Arcot are the two great groundnut producing districts in the Presidency. These two districts have roughly 459,000 and 372,000 acres under groundnut. Among the southern districts Madura is second only to Trichinopoly which has an area of little less than 106,000 acres. It is interesting to know as a sort of useful comparison that though the area under groundnut is comparatively small in the Coimbatore District, yet the crop raised in Pollachi Taluk is the finest variety of nuts; and due to the early outbreak of the S. W. Monsoon and early sowing, the crop is thrown on the market rather very early.

Now let us turn our attention to Sugarcane, another important money crop of the Presidency. In the Madura District sugarcane occupies somewhat a lower place. About 12 districts have exceeded this district in the production of cane. The area under Sugarcane is about 3,000 acres. Vizagapatam is the greatest Cane producing district and South Arcot comes next, while Nellore and Kistna have lowest production. Madura, unlike Coimbatore, is not ideally suited for the cultivation of Sugarcane. Coimbatore has ideal soil and all the advantage of a tropical climate; and added to these there are no difficulties of drainage.

In South India as a whole compared to North India there is a very slow expansion of the area under Sugarcane. This is due more to economic than to physical causes. The cultivating costs of this crop is very high compared with other crops; but the chief trouble with Sugarcane is that there should be a great demand, so that it might be converted into jaggery or sugar and be disposed of. So there should be a large number of Sugar Factories to absorb the canes produced in the neighbourhood. This was the suggestion of the Sugar Committee with regard to the extension of cane in South India.

Gingelly occupies roughly 23,000 acres and it is largely grown in Periakulam, Dindigal, Melur, Nilakkottai, Palni and Tiruman-

galam Taluks. Vizagapatam is the greatest gingelly producing district in the Presidency. Madura has the lowest acreage under Gingelly among the Tamil Districts. It is largely grown in Dindigal and Melur Taluks. There is a very small area under Castor in this District, viz., roughly 5,000 acres. Anantapur has the largest area (67,000 acres) under this crop and Salem has the largest area among the Tamil Districts. The present Directors of Agriculture and Industries are very much interested in the growing of this crop. They are making a detailed study of this particular crop to find out ways of improving and expanding it. They have undertaken the study of this crop to introduce the Eri silkworm from Siam which feeds on the castor leaves. Their object is to have a progressive and prosperous Eri silk industry shortly in this Province. Another important point to note is that the area under cultivation of this crop has increased in recent years. This is partly due to the demand created by the aeroplanes for lubricating oils. By experience it has been proved that castro-lubricating oil cools the engine when 'plane travels at a tremendous speed.

The human element or the "man behind the plough" is also a very important factor that determines the productivity of a region. The quality and the yield of the crops raised in Madura depend much on the ability and skill, industry, patience and prudence of the peasants. Some of the writers have gone so far as to say that "the man behind the plough" is more important than the land on which he works. It is true that praises have been showered on the peasant-proprietors of different districts for their skill and industry. Their patient struggle against the continual uncertainties of the season and other difficulties is something remarkable. The Madura ryot is not lacking in practical knowledge of his work; but if he does suffer by comparison with the peasant-proprietors of other countries it is because of his illiteracy and poverty-stricken condition and the vagaries of the seasons.

Fruit Trees and Vegetables. *Fruit Culture.* The demand for fruits from the middle classes is on the increase and there is immense scope for cultivating fruit trees and vegetables in the district. The red ferruginous soil of the taluks of Dindigal and Kodaikanal, which is friable and somewhat deep at places, is quite suited to the cultivation of fruit trees; and these two taluks have the largest area under fruit and vegetable cultivation. The total

area in the district under fruits and vegetables, including root crops, is roughly a little more than 26,000 acres. Vizagapatam has the largest area, and Madura stands fourth in the Presidency. Of this total area in the district, Plantains and Mangoes occupy roughly 15,000 and 4,000 acres respectively. Madura stands second in Plantain cultivation in the Presidency, while Malabar is the first, having an area of 51,000 acres. Plantains occupy more than half of the total area under fruits, vegetables and root crops. This is because they form one of the chief products of commercial importance on the hills. They are a peculiar species; and the fruits are of a very good quality, quite famous in the Tamil Districts. An interesting feature of this crop (hill-plantains) is that they continue to bear fruit for 20 or 30 years. The wells of Dindigal play an important part in the production of this crop.

The soil and the climate of this district are not quite conducive to Mango cultivation.

Native vegetables thrive well on the soil of this district; and in Kodaikanal European vegetables are grown as the climate and the nature of the soil are favourable for their production.

Figs and Tomatoes, which have all the four vitamins in plenty are a perennial and cosmopolitan crop; and these can be usefully grown by the ryots of this district. If a demand for this crop can be created in this second city in the Presidency by educating the people regarding their food value, then the ryots of this district will have a chance of growing one of the very highly paying crops.

In the Madura District the agriculturists form three-fourths of the population, while the remaining fourth depend for their welfare upon the prosperity and spending power of the tillers of the soil.

The following castes are the important ones that form the majority of the cultivating class in this district: The Kunnavans, Nayakkans, Valayans, the Reddies and the semi-cultivating caste of Kallars of Melur and Tirumangalam Taluks. The Kunnavans are the principal cultivating caste on the Palni hills. Their ancestors were Vellalans from the Dharapuram and Kangayam country in the Coimbatore District and they are sometimes called Kunnava Vellalars. These, like their neighbours in Coimbatore, are very industrious and efficient cultivators. The Valayans of the Madura

District are gradually taking to agriculture now-a-days. The Valayans, the Nayakkans and Reddies of Tirumangalam are also not backward in displaying their skill and efficiency in this ancient of all human occupations. It should be noted as a point in contrast that the majority of the ryots who raise dry crops are somewhat careless and unenterprising.

The Kallars of Melur and Tirumangalam Taluks belong to the most prominent of all the castes in the district. They were noted for their inveterate addiction to dacoity, blackmailing and theft, but there has come about a remarkable change for the better in their way of living. Through education, a good many of them have been reclaimed; and especially after the Periar project has come into operation, the people of this caste, round about Melur, are taking energetically to wet cultivation, thus gradually forgetting their old habit of cattle-lifting. It is somewhat interesting to note that by some sort of agreement between themselves, they do not remove cowdung from their fields for fuel purposes. Thus, education and the activities of the Public Works Department have "made an honest man of the notorious Kallan."

Now before concluding I would like to make a few observations regarding the working of the Department of Agriculture in this district. The Deputy Director of the VI Circle, viz., Madura, Ramnad and Tinnevelly Districts, has his headquarters in Madura. There are agricultural demonstrators in Palni, Dindigal, Melur, Cholavandan and Tirumangalam. There is an Agricultural Middle School at Usilampatti.

The authorities are doing their best in introducing to the ryots better sorts of Paddy, Ragi, Cholam and Cotton, and short and line planting of Sugarcane. They also supply the ryots with better and selected varieties of seeds, and especially green manures whenever there is a demand for the same. With regard to implements, they have introduced the standard types of ploughs, viz., H. M. Gintakas, drilling implements and improved Sugarcane pans. Besides this, the authorities are also gradually educating the ryots with regard to the proper methods of preserving cattle manure and manufacture of comforts, the value of green manure crops for increasing organic matter in both garden and wet lands, and also the value of oil cakes for Sugarcane. Their advice on proper care of cattle, ensilage and fodder crops, on clean preparation of Jaggery and construction of Sindewahi furnaces, on proper me-

thods of combating plant pests and diseases and the use of sprayers, insecticides, etc., is really remarkable. Demonstration plots in the ryots' holdings under departmental supervision and exhibitions at all important fairs and festivals by means of Motor Vans and Lantern Lectures are some of their excellent methods of educating the poor ryots of this district. Formation of Agricultural or Co-operative Associations for sale of implements, etc., is another important activity of the Department. Finally their efforts to introduce Poultry-farming as an important bye-industry in this district should be highly commended.

While bringing this paper to a close, I would like to bring home the importance of this ancient industry of ours at the present juncture of our economic struggle. That gentlemen of means and education should pay more attention to agriculture is the crying want of the country. The problem of middle class unemployment is staring us in the face.

Owing to the present depression, the Government and private services are not in a position to afford sufficient scope to the ever-growing numbers of the educated. Manufacture is beyond the reach of many of them. The learned professions are crowded. The question as to what the sons of middle class men should do in order to earn a living is constantly rising in our minds. The answer is that they should look to the mother earth for their maintenance. They should cease to feel it degrading to plough the land or to feed the cattle. They should learn to hate the show and the excitement of town life and to delight in the wholesome, free, sweet, sublime, life of a villager working for the benefit of mankind. What is more refreshing, invigorating and exhilarating than the blue sky, the green fields and the fresh breeze of a village—than to hear the birds warble, the shepherd boys shout, to see the crops grow, the cattle graze, the cornfields wave and change hue under the autumnal sun far away from the din, the dust and the strife of town life?

Civilisation of a Lost City in Sind

BY

DR. K. N. DIKSHIT,

Discoveries made after extensive excavations in the lost city of *Mohenjo-Daro,* considered to be about 5,000 years old, in the Valley of Sind, was the subject of an interesting lantern lecture delivered by *Dr. K. N. Dikshit,* Government Epigraphist, at a meeting of the *Madras Geographical Association* held at the Teachers' College, Saidapet on Saturday the 30th July 1932. Mr. K. A. Nilakanta Sastri, Professor of Indian History and Archæology, Madras University, presided.

After explaining the clues which led to the exploration, the lecturer said that the excavation of one area brought to light no less than 25 wells in good condition, which were now being used. The discoveries included well-cut drains, well-laid out parks and beautifully-planned houses. These showed the high level of comfort the people of the city was enjoying and their advanced ideas of town planning, sanitation and other civic amenities.

USE OF BRICKS

In another part a number of parallel walls were found. The bricks used were of a regular size. The archæologists were confounded as such bricks were supposed to have first come into use after the advent of the British. A stone statue was also found. The facial angle of this statue was most marked and it was evidently a sign indicating the high intellectual order of the people who dwelt there. On the statue was engraved a garment which proved to be a kind of shawl worn by the people.

In another part a worn-out, corroded object, which looked like a cup with the lid very firmly fixed, was found. On breaking the cup about 55 gold and silver objects were found. Among these were several ornaments such as pendants, wristlets, etc., similar to those worn by Marwaris to-day. There were some blocks of silver pieces which could be called the earliest coins in use in the city.

What struck one most was the absence of iron. Every thing found in the city was of copper and stone. A small copper saw to cut a conch was found. The presence of conch gave rise to the belief that the people of the city had dealings with South India as that material was found there. Silver ornaments which would do credit to modern jewellers were also found.

PAINTED POTTERY

One vase of painted pottery, which stood two feet high, was painted in different designs. Such pottery was in existence in Baluchistan and it was yet to be determined whether the painted pottery of Baluchistan or of Mohenjo-Daro was the earliest.

There were symbols of the idol of Siva and a man written on stones. Probably, said the lecturer, the worship of Siva could be traced to that period.

Continuing, the lecturer said there were a number of scripts engraved on stones. The inscriptions usually began with the letter 'U' along with a fighting ram, sheep, a tiger, a six-headed monster or some other object. These might, probably, be something in connection with the religious observances of the people or they might be different kinds of seals used by each man as the writing was in reverse.

There was no variation in the script either from the lowest or from the highest. It was absolutely impossible to identify them with that of any other language in India. Nobody had yet been able to find out the language of this script. When this was done it would probably throw a good deal of light.

LOST CIVILISATION

In conclusion, the lecturer said that the Indus civilisation was found to begin somewhere in Ambala district. The close resemblance found in excavation here led one to conclude that further excavations, if continued, might indicate a long lost Indo-Gangetic civilisation.

There was no chance of the Indus Valley being explored at present owing to retrenchment.

The Geography of the Universe*

By

Dr. I. Ramakrishna Rao, M.A., Ph.D.,

Lecturer, College of Science, Andhra University.

The Geographer, in the usual sense of the word, lives in the terrestrial world, studies the distribution of land and water there, the positions of continents and countries, their populations, the occupations of these populations and their mutual relations. But the Geographer of the universe, the scientist, lives in a larger world which consists of a great number of inconceivably large island universes each containing within itself millions of stars similar to the sun of which the earth, the object of study of the terrestrial Geographer, is a small planet. The subject of the present address is the Geography of this larger world, the universe.

Now what is the space over which this Geographical survey has to extend? Is it infinite in extent as is usually conceived by the layman, or is there a limit to this wonderful creation? The revolutionary scientist of the twentieth century, Einstein, has given an answer to this. From theoretical considerations, he came to the conclusion that the universe is finite, yet unbounded. This may appear at first a contradiction in terms, but it is not difficult to comphrehend, when we consider the analogous case of the earth, which for all appearances is a plane surface extending to infinity in all directions, but which we now definitely know to be a finite spherical body without beginning or end and therefore unbounded.

On account of the vastness of the distances concerned in the celestial sphere, which forms the subject of our survey here, our units of measurement have to be entirely different from those used for the Geographical survey of the earth. The mile or the kilometer are units too small to express interstellar distances,. The scientist has therefore chosen the light-year for the measurement of these vast extents of space. Assuming that light travels at a

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rate of 186,000 miles per second, a light-year is the distance covered by light in one year, which is about six billion miles. The immensity of interstellar distances, which are more than thousands of light-years, can be realised, when one understands that light takes only about one-eight of a second to go once round the earth.

Next we come to the instruments with which these magnitudes are determined. Our measuring links are not of iron or steel, but are non-material rays of light. The survey is not made by travelling in steamers, or as is now-a-days done, in aeroplanes, but sitting at a single place in an observatory, the Geographer of the universe, turns his little instrument, the telescope, to different parts of the sky and maps the whole celestial globe that surrounds him. Results of observation for the last tens of centuries have revealed us only a very minute fraction of the whole creation. When the survey of even the tiny little earth, with all the conveniences at our disposal, takes so much of our labour and effort, it can be easily conceived how difficult it is to survey the universe which is infinitely large compared to it.

The telescope only enables us to study the retative positions of the stars and their distances from us and such positions have to be read regularly for centuries to get any knowledge of their movements. But there is a wonderful instrument of the physicist, called the spectroscope, which reveals to us the wonders of the heavenly bodies. It not only measures their velocities with respect to us, but also enables us to get an idea of their temperatures and constitution, thus it serves the treble purpose of a speed counter, a thermometer and a chemical analyser combined in one.

When it is said that the spectroscope acts as a meter for recording the velocities of the heavenly bodies, it does not mean that it directly marks in numbers so many miles per second or per hour. The velocity is indirectly determined from a study of the spectrum emitted by any particular star, which is photographed by this instrument. A familiar terrestrial example will explain as to how this is possible. It is a common experience that the pitch of the whistle of an approaching train is different from that when it is receding. There is a theoretical means by which one can calculate the velocity of a train from a knowledge of the pitches of its whistle while approaching and receding. An exactly similar phenomenon happens when an incandescent body is moving with respect to any observer. Every star, as is very well known, is a

source of light. The spectroscope in conjunction with the telescope records the spectrum of the light emitted by the star, a close examination of which reveals a number of lines, either light or dark depending upon the nature of the star, whose position in the spectrum depends upon the state of motion of the star. If of three stars, emitting the same type of spectrum, one is moving away from us, a second moving towards us and the third stationary with respect to us, the lines in the spectrum of the former are found to be displaced towards the red end of the spectrum and those in the latter towards the violet end with respect to the position of lines in the spectrum of the stationary star. Every line in the spectrum, which corresponds to a particular frequency of light vibration is analogous to the pitch of the whistle of a train, and a displacement of it in the spectrum due to the motion of the star is nothing but an indication of a change of this frequency similar to the change in pitch of the whistle of the moving train. A quantitative relation exists between this displacement of the spectral lines and the velocity of the star with respect to the observer. Thus a study of the spectrum of any star gives a clue as to its exact velocity.

Each of the elements constituting the different forms of matter on the earth has, what is called, its characteristic spectrum. the position of the bright lines in which is different for different elements. Thus if there is a luminous body like a star, whose spectrum consists of a number of lines, the constituent elements of the star can be determined by studying the position of the spectral lines characteristic of it.

While different substances give different characteristic spectra, the same substance gives different spectra under different conditions of temperature. Thus if we trace from the spectrum of any star, the lines corresponding to any element, the approximate temperature of the star can be easily calculated. This close correlation between the temperature of a star and the type of spectrum it emits has been first explained by the eminent Indian Physicist Megh Nad Saha, to whose important work in this direction is mostly due our knowledge of stellar temperatures.

Having thus far dealt with the instruments of the Geographer of the universe, I now come to a description of the results. I begin with a little cloud containing as many, if not more, of stars as there are water droplets in a rainy cloud with which we are familiar,

The sun forming the nucleus of our planetary system, is only one of the large number of stars contained in such a cloud. A large number of such clouds constitutes, what is called, the galactic system otherwise called the milky way, which is seen on a dark clear night as a girdle extending from one end of the celestial sphere to the other. The extent of this milky way is so vast that light takes at least 800,000 years to pass from one corner to the other.

Such an immensely vast galactic system, which is by itself a universe, is only one of millions of nebulae, which are little island universes, with which Dame Nature plays her game of marbles.

What is the constitution of these celestial bodies and what are their temperatures? How are they disposed in space with respect to us? Are they stationary, or are they moving with great speeds? These are problems which the spectroscope has solved for us. Beginning with our nearest star, the sun, a study of its spectrum has revealed lines characteristic of most of the elements existing on the earth. It is this fact that has led us to the theory that the earth was, once upon a time, a part of the sun, and that in one of her frolics Nature sent a swiftly moving star adjacent to the sun. On account of the violent tides created in the sun as a result of the close passage of such a star, large pieces of molten matter separated with enormous velocity from the sun and formed what we now see as the planets of which the earth is one. With time these masses cooled down and have finally come to the present stage. Thus every particle constituting our bodies was once existing in the sun, in a form which was entirely different. Spectra of other stars also have revealed the existence of some of the terrestrial elements in them. These bodies exist at very high temperatures as is evidenced by a study of their spectra, temperatures so high that, if the earth were placed in one of them, it would not only melt in no time, but the matter constituting it would be converted to its most elementary form, thus losing all resemblance to its previous state.

As regards the state of movements of these bodies, the astrophysicist finds in the galactic space, two streams of stars one moving opposite to the other. The present theory of these is that they may be two star-clouds moving in opposite directions, which on account of their nearness to us reveal their constituent stars. Finally there are the nebulae, whose study indicates that all of

them are moving away from us in all directions. Being large universes of matter, they should have immensely large gravitational attraction to one another resulting in their mutual approach. But their repulsive movements indicate that there is something wrong with our understanding of the law governing their mutual influences. The law of gravitation propounded by Newton is found not to have a simple and direct application to small bodies at exceedingly short distances from one another. Perhaps, a similar failure of the law may also apply to infinitely large distances like those between the nebulae. The fact that these nebulae are receding from one another leads us to the conclusion that the universe is not constant in size but is expanding perhaps to burst into nothingness after a time, when the earth may have lost its existence altogether.

This is in short the Geography of the universe. The insignificant status of man in it is clear. But his importance lies in that he is the observer or, what our philosphers call, the Sakshi, without whom there arises no question of the world or the universe. The modern scientist has also come to the stage when the all important role of the observer is being realised. Einstein is perhaps the pioneer in driving us to this conclusion.

Before closing this address, I desire to bring home to you one important feature in the picture of the universe that I placed before you, how far this is real. Walking along the beach on a dark clear night, you look at the sky and find a large number of stars which you consider to be huge bodies of incandescent matter. Are they really in the positions in which you see them? The discovery of the finite nature of the velocity of light has denied this to us. A star emitting light is at a large distance from us. and the only means of observation, the light ray, takes a very long time to travel from it to us. Thus what we see actually is the position of the star when it first sent the particular ray of light which reaches us at the time of observation. The particular ray must have started a thousand or so years ago, if the star is at a distance of 1000 light years from us. In this interval, the star must have changed its position to a very large extent. Thus what we actually see is not its present position but that a thousand years ago. As far as the study of the universe is concerned, we are in the same unreal position as that of a blind man trying to locate positions of moving terrestrial bodies by the sense of sound.

Another complication which arises as a consequence of this is the incorrectness of the relative positions of the stars. Two stars which we notice as being close together, may not be at the moment of observation really close. For, if at the moment they sent light, they were moving away from one another, during the time taken by light to reach us, they must have moved considerably away from one another.

The only way out of this unreality is the services of a messenger, more efficient than a light ray travelling with infinite velocity. We can have a real picture of the celestial sphere through him. But Einstein has definitely proved that the velocity of light is the maximum limit for any interstellar communication in this universe, and has said that any attempt to find a larger velocity is bound to fail. Thus we are left in despair as to attaining the reality behind all this confusion of arrangement in the larger world. But it is Einstein again who asks us not to despair, as we are not physically concerned with reality. Physics deals in observations and proposes theories to explain these observations. Thus the scientist must be satisfied with this and should not aspire for more which is physically unrealisable.

There are other aspects of this Geographical survey of the universe as regards man's place in it, the possibility of existence of other spheres like our own wherein may live beings similar to us, how far man can communicate with them, how he can exploit the extra-terrestrial resources not only for the advancement of his intellectual self, but also his physical being. But these problems take too long to be discussed here.

Solar Radiation

By

MR. C. K. ANANTHASUBRAHMANYAM, B.A.

It is upon the supply of the Sun's rays, that heat, light, power and the growth of all living things upon the earth depends and hence the measurement of the intensity of the total supply and the determination of the different varieties which compose the rays are of great importance. The quantity of heat received per square centimetre of surface per second, normal to the sun's rays, is the measure of solar radiation. This quantity is known as the Solar Constant. Several investigators found a regular fluctuation in this quantity. A good deal of research work is now being conducted to decide whether this variation is purely due to atmospheric and other changes on the earth or has its origin in the sun itself. Langley says that variation in the number and magnitude of sun-spots cannot directly produce any sensible effect on terrestrial temperatures, but even slight changes in the depth and density of the Sun's absorbing layer would make a great difference. The nucleii of Sun-spots radiate much less heat and light and the faculae more, than the neighbouring regions. The umbra of a spot emits about 54% and the penumbra about 80%. So, the direct effect of a Sun-spot is to make the earth cooler. But, spots are due to, or accompanied by an eruptive action, the internal hotter gases bursting through the photosphere and hence we get 3 or 4% more heat at the time of maximum spots.

The instrument for measuring the solar constant is known as the Pyroheliometer. Another instrument for measuring the energy contributed by the individual rays of the spectrum is known as the Bolometer. Nearly 50% of the Sun's radiation is intercepted in the atmosphere even when there are no clouds. From a certain quantity known as the 'transmission co-efficient', the amount of heat received if no air had intervened can be deduced.

If the normal incidence intensity is I and I_0 the true solar constant, then $I = I_0 a^m$. 'm' is the length of the path of solar rays

through the atmosphere and 'a' the solar altitude. Now $m = \frac{\text{Atmospheric refraction in seconds}}{58{\cdot}36'' \times \sin Z}$ where Z is the Sun's zenith distance. Solar altitude is calculated from the formula: $\sin a = \sin \phi \sin \delta - \cos h \cos \phi \cos \delta$, where 'a' is the altitude, 'h' Sun's hour angle from the meridian, ϕ latitude of the place and δ solar declination.

Effective solar radiation $S = S'(1-a)$ where S' is the intensity of the incoming solar radiation and 'a' the albedo of the earth and its atmosphere. According to G. C. Simpson, the outgoing radiation from the earth depends on (a) the surface temperature, (b) the temperature of the upper surface of the clouds, (c) the temperature of the stratosphere, and (d) the amount of clouds. $R = R_1 (1-C) - R_2 C$, where R_1 is the intensity of the outgoing radiation for clear sky and R_2 the intensity for overcast sky and C the cloud amount expressed as a fraction of the sky. The temperature of the upper surface of clouds is 269° A in all parts of the world and the temperature of the stratosphere a simple function of the latitude.

The normal value of the solar constant is 1·95. Dr. Abbot has shown that when radiation values are arranged in the order of increasing magnitude, the average of the Sun-spot numbers also show a progressive change. Dr. Abbot has also found that, when the solar radiation increases, the intensity of the short wave radiation increases. This is in accordance with the fact that, when a body increases in temperature the proportion of short wave radiations increases.

The new method of Abbot, 'selected pyroheliometry', depends on the selection of moments when the Sun is equally above the horizon, the atmosphere equally clear, the quantity of atmospheric water vapor identical, and the month of the year same, so that the temperature conditions will be substantially comparable both around the recording instrument and in the atmosphere itself. Under such circumstances, the atmosphere although it reduces the intensity of the Sun's radiation, reduces it in the same proportion on every chosen occasion. Accordingly pyroheliometric measurements of total solar radiation made at such moments should show the same percentage variations of the Sun's heat as the solar constant observations in which atmospheric influences are eliminated.

The results indicate a long period oscillation of about 2·5%. The difficulty lies in actualy finding a sufficient number of days on which there is a corresponding state of atmospheric conditions. Now, the elimination of the influence of the earth's atmosphere clearly shows a remaining oscillation which has its origin in the Sun itself.

Coming to the individual spectral regions we find that the red and infra-red do not vary almost, but the variation keeps on increasing as we go to the shorter wave lengths. Abbot finds relatively strong oscillation in the region λ 5000 to λ 3500. Petit investigated and compared the intensity of radiation at λ 3100 and λ 5000 and found an oscillation of 56 %. He established, that the march of oscillation remains unchanged regardless of whether the values are determined for air mass 1, or extrapolation is made to space outside the atmosphere, that is for air mass 0.

Dobson found a yearly march in the ozone content of the air. Now the question arises, whether the march of oscillation is due to changes in transparency of the atmosphere caused by the ozone bands. Petit demonstrated, that the values for ultra-violet radiation are not materially influenced by the ozone content. To an increase of 100% in ozone there is a corresponding diminution of only 5% in ultra-violet intensity. Therefore Petit concludes that the oscillations have their origin in the Sun itself.

The long period changes which we find in the effective temperature of the Sun's radiating surface depend upon the activity of convection in the Sun's substance. The short period changes on the other hand are due to the rotation of the sun, which brings successively opposite to the earth's face, regions of unequal radiating power or perhaps rather of unequal absorbing or scattering power on the Sun's surface. If it is proved conclusively that there are definite uniform periodicities in solar variation, then the radiation of the Sun for years can be predicted in advance. The elaborate work of the Smithsonian Institution confirms the view that there is a correlation in weather conditions with solar radiation.

Summarising we find that the following affect quantitatively and qualitatively the amount of solar radiation and its variation:

I Astronomical: (a) *Solar variability.* (b) Earth's solar distance. (c) the astronomically determined length of day.

II. Geographical and topographical: (a) Hours the Sun is above the horizon which is determined by the solar declination and the latitude of the place of observation. (b) High mountains which may cut off the sun's rays while it is still above the horizon. (c) Altitude: since increase in height above sea level decreases the depth of the atmosphere above the station and also its water vapor and dust content. (d) character of the ground surface, (bare or covered with vegetation etc). (e) Proximity of active volcanoes.

III. Geophysical: (a) Diffusion and absorption by the permanent gases and by the ozone layer at an altitude of about 45 k.m., as well as through cosmical dust. The ozone layer only 3 m.m. thick under normal pressure completely absorbs all radiation of shorter wave length than 290 $\mu\mu$ (b) Fine cosmical dust and condensation products of various kinds for the most part discharged by cathode and corpuscular rays of the Sun present at great heights, deplete the solar rays to a variable degree.

IV. Meteorological: The weather influences extending to the upper cloud limit; principally in the atmosphere as water in gaseous, liquid or solid form. The invisible water vapour acts strongly to deplete the incoming radiation partly through absorption of red and infra-red rays, partly through scattering, like other gas molecules inversely proportional to the fourth power of the wave length, or if dust particles inversely as the square of the wave length.

Some Scenes from South Africa

By

Miss H. A. Edington.

Dear Mr. Subrahmanyam,

I am sending a few "snaps" I took in South Africa which I thought might interest you, and which perhaps you might like to use for the "Geographical Journal", together with some explanatory notes, though of course what I am going to say will be no new information to yourself.

While in South Africa I travelled in the Transvaal, Rhodesia, and part of Cape Province though the greater part of my time was spent in the Transvaal, so I will confine my remarks to that district.

After leaving Colombo our boat the "Kathiawar" called at Beira and Laurenço Marques, both in Portuguese East Africa. The former is a low-lying, sandy, rather uninteresting, and unhealthy town; the latter is much more imposing and better in every way; it acts as an inlet and outlet for the Johannesburg district. It was the nearest port for my destination which was Pietersburg—the capital of the Northern Transvaal, but as I wanted to see Durban I went on to that town.

Durban is a fine town with broad streets and good buildings. I suppose one of its striking features to a visitor is its rickshaw boys—Zulus who dress very picturesquely and wear enormous head-dresses of horns, plumes, etc. I arrived during the first week of February—towards the close of their hot season, and, even after Madras, found it rather warm.

The train journey to Pietersburg takes two nights and the greater part of two days. The train climbs up and up, through some magnificent scenery, from the narrow coastal plain to the plateau, where the change in temperature at night is most marked; I found it very cold after a hot day.

This interior plateau is at an elevation of from 4000—5000 feet or more, so of course experiences the extremes of climate

characteristic of plateaus; also, being hundreds of miles from the sea, it suffers drought for the greater part of the year. The rainfall of the interior is at best but scanty, and the heat of the sun soon dries up what moisture there is.

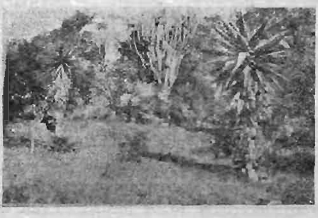
As the year goes on the veld becomes drier and drier, browner and browner; for mile after mile the land presents a parched, scorched, appearance. Dust becomes thicker and thicker giving rise to troublesome dust storms which reach their climax about August.

The rivers and streams are raging torrents during the wet season (which coincides approximately with the hot season), drying up during the dry season in most cases to mere trickles of water, or chains of pools, and sometimes leaving their channels quite dry, or merely marked by a line of vegetation indicating subsurface water. Even the great Limpopo River, which looks so imposing on a map, is reduced to a small stream winding its way between mud-banks amongst rocks.

These characteristics of South African rivers—the alternation between torrents and dry channels—render them useless for navigation. Bridges over them are comparatively scarce, though the Government have recently been constructing some, hence in the majority of cases they have to be forded. Even when after the rains the spruits (as they are called) have dried up, a sudden storm may spring up, and in an hour or less one's road may be rendered impassible by one or more of these rushing streams which cross it at intervals. In this case the only thing to do is to wait on the bank until it subsides—which it may do in a few hours.

Photograph No. 1 shows the Lundi River (in S. Rhodesia). It is a fairly large one when full. The "snap" was taken in May, soon after the end of the wet season, which is later here than in the Transvaal. The river has already shrunk considerably in size; the width of the bridge indicates that of the river when full; when in flood the bridge is dangerous to use; in the photograph it spans chiefly dry rocky bed with a narrow stream of water meandering through it. This is the type of bridge the government have been constructing lately in this district; it is reached on both sides by a steep declivity. Until quite recently even the Limpopo River had to be forded; now a fine bridge, called the Beit Bridge after its constructor, spans it.

1. Lundi river and bridge: Southern Rhodesia. Kopjes and savana land.



2. Foot of a typical Kopje: low veld vegetation (aloes and naboom). North Transvaal.

3. Army plane alighting near Pietersburg, North Transvaal, when trying out the Cape to Cairo air Route: High veld.

On the plateau a difference in altitude of 500 feet makes a marked difference in the vegetation. The Transvaal is largely pasture land, trees being found in more sheltered spots or in the lower lying parts; much of this pasture land is what the Dutch call "sour veld". On the "low" or "bush" veld trees are numerous, but they are mostly low-growing ones, and of little value for timber; many are thorny e.g., the mimosa or wattle; aloes, prickly pear, and naboom abound (see photo. 2). On the "high" or "grass" veld vegetation is practically confined to coarse grass, though plants of the prickly pear type may be found. Usually however as far as the eye can reach little but grass can be seen, stretching out in a level expanse broken only by kopjes—masses of granite or gneiss (see photo 1, 3 and 4.), with perhaps a line of hills in the distance: dotted across the veld are numerous ant-hills, some being 20 feet in height; they are very friable, and the Bantus use the earth composing them in the making of the walls and the floors of their huts.

The comparative uselessness of the indigenous trees has led the Government to introduce more valuable ones from other countries, chief of which are the blue gum and the wattle. Plantations of the former are to be found in various places, and most of the farmers also have planted them around their dwelling places. Other "introduced" trees are various species of pine and fir which are to be found usually at greater altitudes than the blue gums. Photograph 3 shows a typical view across the high veld, near Pietersburg, with a kopje in the far distance; the dark patch at the foot of the kopje is a fir plantation round a farm house; the aeroplane is one of the three army 'planes which were testing the proposed "Cape to Cairo" Air Route in February of this year; Pietersburg is to be one of the regular landing places, and already has an embryo aerodrome.

Photo 4 is a view across the high veld in the south-east of Cape Province near a village called Elliot, which lies amongst hills forming an offshoot of the Drakensberg in the Maclear district. The ox-waggon is the type used so much by the Dutch; these Dutch, or Boers, travel from place to place in their waggons—"out-spanning" for meals or a rest, and at night time. The back part is covered by a hood of wood and canvas, and affords shelter to the family; the front part is uncovered and is used to carry various things—very often a load of firewood collected by the Boer, and taken to the nearest town or village for sale there. The waggon

4. Boer ox-waggon; traversing low veld country

5. The little village of Elliot in winter (June)—snow-covered (about 5000 feet up in the Drakensberg region: South-East Africa).

6. Zambesi gorge: river bridge from Falls Hotel.

is drawn by a team of oxen consisting of anything from 6 to 10 span; their rate of travel averages about 12 miles a day. The driver either sits on the waggon or runs alongside the team wielding a long whip with which he can reach the front pair of oxen; guiding a team of 12 or 20 oxen calls for great skill, which is shown by these drivers—whether Dutch or Bantu; usually a boy walks at the head of the team however.

Photo 5 shows the village of Elliot in June, buried in snow; the bungalow on the left is where I stayed for a month; the trees in this district are chiefly fir trees; the village is about 5,000 feet above sea-level, so while it has very hot summers its winters are exceedingly cold—although of course the sun shines brightly, which minimises the effect of the cold air. During this fall of snow the village was completely cut off for some time from the outside world. Our water taps were frozen, and we had to have fires lighted outside the house under them to thaw them before we could get water; later on after another frost the sun thawed them.

Photo 6 is the Zambezi gorge just below the falls whose extremity shows mistily in the distance—just beyond the railway bridge; the bridge, of course, is the one which carries the railway into northern Rhodesia; I have walked across it several times. The "snap" was taken from the grounds of the Victoria Falls Hotel just where the river makes its first bend in its gorge—you can see it flowing away from you on the right hand side of the photo. The sides of the gorge are about 400 feet high—though they don't look it.

No. 7 is the "Cream of Tartar" or "Baobab Tree". There are very many of these immense trees to be seen in the northern Transvaal in the neighbourhood of Messina—not many miles from the Limpopo River; they tower above the other vegetation and can be seen standing up, dark and practically devoid of leaves in April or May, showing up by contrast from a long way off. They are of great girth—30-40 feet or more. You may have seen some yourself in India. The fruit was hanging on the trees when we saw them. It is pale green, with silky hairs outside, and a creamy-white hard interior. (I am afraid this is not a good photo: the light seems to have got into the camera.)

7. Giant Baobab (Cream of Tartar tree): circumference of trunk about 40 feet. Near Limpopo river.

8. Typical Bantu hut—mother carrying child in her back. Another child is eating her dinner out of a gourd.

9. Women in native dress waiting for the dancing at the installation of their new chief.

No. 8 shows the wife of a Christian teacher away out many miles across the veld; she has her baby slung in a fold of her blanket on her back and another child is eating her dinner, rather shyly, out of a gourd. The hut is typical, i.e., circular with a thatched and conical shaped roof, though better built than the majority which are of mud, while this is of stones. The woman and children are also better dressed, (or perhaps one might say differently dressed) than the heathen Bantus are.

No. 9 shows some heathen women in their native dress, though they have put on their finery for the occasion which is the installation of their new chief who has just come of age—his mother ruled the tribe during his minority. The women were shy of being photographed, and ran away. They look very picturesque in reality—with bead decorations of all colours—red, white, blue, green, on their dresses, round their necks and heads and across their foreheads and faces. As you may see, their heads are shaven.

Extracts

Geology and Geography of India

FROM DR. L. L. FERMOR'S PRESIDENTIAL ADDRESS

At the Science Congress in Patna

GEOLOGY IN THE LIFE OF A NATION

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I now propose to discuss, in as general a manner as possible, a subject of more specialised interest, namely the Place of Geology in the life of a nation.

Those of you who have pondered upon the relationship between cause and effect must realise that anything that happens now to any person or thing may be regarded as the latest unit in a continuous chain of cause and effect. And you will probably permit me to summarise epigrammatically the results of your thoughts by likening life to an algebraical equation.

As you know, an important feature of such an equation is that the sum of the items on the right side must equal the sum of the items on the left side. Life is rather like this. A present happening may be regarded as the right side of an algebraical equation, and all the events that have led up to this happening may be regarded as constituting the left side of the equation.

To take an example, the fact that I am addressing you this evening, here, depends upon the facts, among many others, that I was born on a certain date, that I took up the study of science, that I was diverted to geology from metallurgy, the profession I originally selected, that I secured an appointment in India, that I have remained in service until this date, that your Council chose this place and date for our meeting and selected me to preside, and that I have succeeded in reaching this room without being involved in any accident. If any one of the facts mentioned had been different, I should probably not be here this evening.

An equation of this type, that is to say one involving cause and effect, differs in one essential particular from the algebraical equations of our class rooms. The equations of our school algebra are static equations, whereas those of the type we are now discussing

are kinetic ones. For, on each side of the equations of life there is an energy factor implying movement in the past and the possibility of movement in the future.

It is this energy factor that conditions Evolution, which, using our simile, may be described as the grand and impressive kinetic algebraical equation of the universe, on the left side of which is included not only the magnificent succession of events constituting the evolution of the stellar universe, but also the section of these events that has led to the evolution of the solar system and the birth of our planet; in addition it includes the much smaller though to us vitally important, series of events that has led to the evolution of life upon our planet including the evolution of Man, followed by the still smaller series of events that constitutes the progress of human history down to its present point. The major portion of this grand series of events is the field of study of the Astronomer. With the formation of the earth, the field of study of the Geologist was provided. The evolution of life falls also within the realm of the geologist; but the latest section of this series of events, affecting human beings, falls within the sphere of studies of the Historian. The study of the present results of this evolutionary series of changes falls within the realms of geography, meteorology, botany, zoölogy, and anthropology, to mention sciences that in their historical or fossil aspect are comprised under geology.

You will now ask: Then what is geology and the true field of study of the geologist? I cannot do better than quote the two opening paragraphs of Sir Archibald Geikie's Text-book of Geology'.—

'Geology is the science which investigates the history of the Earth. Its object is to trace the progress of our planet from the earliest beginnings of its separate existence, through its various stages of growth, down to the present condition of things. Unravelling the complicated processes by which each continent and country has been built up, it traces out the origin of their materials and the successive stages by which these materials have been brought into their present form and position. It thus unfolds a vast series of geographical revolutions that have affected both land and sea all over the face of the globe.

Nor does this science confine itself merely to changes in the inorganic world. Geology shows that the present races of plants

and animals are the descendants of other and very different races that once peopled the earth. It teaches that there has been a progress of the inhabitants, as well as of the globe on which they have dwelt; that each successive period in the earth's history, since the introduction of living things, has been marked by characteristic types of the animal and vegetable kingdoms; and that, how imperfectly soever they may have been preserved or may be deciphered, materials exist for a history of life upon the planet. The geographical distribution of existing faunas and floras is often made clear and intelligible by geological evidence; and in a similar way, light is thrown upon some of the remoter phases in the history of man himself.'

From this you will gather that geography is the branch of geology that describes the particular shape and form of the earth's surface at the moment. With the continuance of the operation of geological processes, geography changes slowly through the ages, and looking backwards and making use of geological observations, we find that at previous periods in the earth's history the distribution of land and water, of mountain and valley, has often been vastly different from the present.

The geography of the earth at any moment, including its climate, flora and fauna, and the inherent possibilities of further change, is, in fact, the right side of that kinetic algebraical equation, of which the left side is the geological history of the earth down to that moment. In fact, in mathematical parlance, the geography of the earth is a function of its geological history.

Those of you who have studied history, by which I now refer to human history, must have noticed the extent to which this history is related to geography: how coasts, seas, rivers, mountains, and climates, have exercised an important influence over the migration of races, and their struggles—one race with another and upon the distribution of tribal and national boundaries. It is probable, nevertheless, that the majority of you have not realised that the guiding factors underlying geography were geological ones, and that, in fact, the events that constitute geological history have exerted a profound and far-reaching influence upon the history of man-kind both in general and in detail.

As you know, the land of the world occupies about a quarter of the surface, the oceans occupying the remaining three-quarters,

According to some geologists, the land area was once vastly greater, and according to most, the proportion of land and sea has varied greatly throughout the ages. One major deduction based on widespread geological evidence is that South America, South Africa, Australia, India, and Antarctica, were once all part of a continuous continent known as Gondwanaland. Views differ as to the method by which this continent was dismembered. According to one hypothesis, known as the hypothesis of continental drift, the existing continents were grouped in Carboniferous times as one continuous land-mass, with all the existing parts of Gondwanaland in apposition to Southern Africa. Subsequently, on this view the continuous land-mass was fractured, with drifting apart of the fragments to form the present continents. On this view, India was once attached to Africa near Madagascar, and gradually floated or drifted north-eastwards.

The second and older hypothesis, whilst accepting the fact of Gondwanaland, supposes that it was formerly a much larger continent than can be deduced by simply fitting the existing fragments together, that Africa and India were then at approximately their present distance apart, and that the separation of these two countries was effected by the foundering or sinking of the intervening portions of the continent. Some geologists find it difficult to visualise the machinery of foundering, and consequently support *in toto* the hypothesis of continental drift. Foundering can be explained, however, either by the compression of rocks underlying the sunken parts of the continent into a denser phase, e.g., gabbro into eclogite, or by the lateral underground squeezing of magma from below the foundering portions. Whichever of these hypotheses relating to the break-up of Gondwanaland be true, the cause has to be found. I do not propose to discuss this here, but only to point to the fact that the existing fragments of Gondwanaland are now separate, and that India has sea-coasts that she would not have had but for this disruption. Mr. West proposes to discuss the hypothesis of continental drift in one of our evening lectures, so that I need not refer further to this question. As a side issue I may mention, however, that the expedition that Col. Sewell is to lead to the Arabian Sea may obtain, if rock specimens in any quantity can be secured from the bottom of the ocean, evidence helpful to the determination of whether India has been separated from Africa by the foundering of the intervening land, or by drifting apart.

"MANY GAPS IN OUR KNOWLEDGE"

India is a large country, whilst the number of geologists who have been at work therein is small; in consequence, there are still great gaps in our knowledge, and our geological map is a very imperfect production. Sufficient, however has been ascertained to reveal the general outline of the geology of India and to render possible a comparison between the geology and the orographical features as represented in these two maps. From this comparison you see at once that there must be some close relationship between the geology of India, that is to say its geological history and the present topographical features. From these maps you will see also that the Indian Empire, as at present constituted, is one of the most natural geological and physical units on the surface of the earth.

Geologically speaking, the Indian Empire may be regarded as consisting of three parts. There is first the Peninsula stretching southwards to Cape Comorin from its apex at Delhi; it is a remnant of the old Gondwana continent. To the north of this is the second unit, the Indo-Gangetic alluvium, composed of sands and clays, laid down, in geologically recent times, upon what is really a bent-down portion of Gondwanaland. To the north of this alluvium is the third unit composed of three mountain festoons with their convexities directed towards the Peninsula. On the north-west is the first festoon composed of the arcs of Baluchistan and the North-west Frontier Province; on the north is the second festoon, the magnificent arc of the Himalaya; and on the north-east, is the third festoon composed of the mountain ranges of Assam and Arakan and the Andaman and Nicobar Islands.

The northern edge of Gondwanaland is actually on the north side of the Indo-Gangetic alluvium, and lies in the outer ranges of the Himalaya; the Assam plateau may also be regarded as a fragment of this old continent; and as the Indo-Gangetic alluvium rests upon what must be regarded as a down-warped portion of Gondwanaland, we can in fact reduce our elements to two, of which one is a fragment of Gondwanaland represented by the Peninsula of India, the Indo-Gangetic alluvium, the outer ranges of the Himalaya, and the Assam plateau. The other element is represented by the three mountain festoons of the north-west, the north and the east, which appear to result from the overthrusting of Asia on to this fragment of Gondwanaland.

There is a difference of opinion whether this relationship has been produced by the underthrusting of the Peninsula of India against the mountain lands of Asia, or by the overthrusting of the highlands of Asia on to Gondwanaland. The resulting Indian Empire, however, is an approximate geological whole with a crude bilateral symmetry about a N. N. E.-S. S. W. line that is reflected in the geography and orography of the Indian Empire. The exact outer limits of this Empire are, nevertheless, difficult to select on geological and, therefore, geographical grounds, and are dependent upon the details of history; but there can be no doubt that, looked at from a broad point of view, Burma, or at least the western portion thereof, must be regarded as an integral portion of the Indian geological and geographical unit.

General geological factors have thus given rise to a natural unit comprised of a hilly and wooded Peninsula bounded on the west, south and east by seas and on the north by fertile plains, which are themselves limited by bordering mountain ranges to the north-west, north and east. The protective action of these bordering ranges would have been complete were it not for the operation of more local causes, such as faulting and river erosion in producing the gaps known as passes. The existence of these passes has had a profoundly important influence upon the human history of India.

Students of this history are aware that throughout the ages there has been a succession of waves of invading races that have taken advantage of the passes in the high mountain walls, specially on the north-west, but to a small extent on the north-east; and they are aware how each successive wave of human invasion has pushed the remnants of the previous invasions further south into the Peninsula.

The fact that the Peninsula of India is bounded to the southward by seas was until a relatively late date in the history of India a limiting factor to changes in that history by providing a boundary beyond which the inhabitants could not be driven by farther invasions from the north, and also by acting as an obstacle to the arrival of any disturbing invasions from the south. Later, however, this very factor of the existence of sea-coasts, once the Cape of Good Hope had been rounded by the Portuguese investigator Vasco da Gama, provided a means by which invaders from a far-distant part of the world, Europe, were able to reach India. Had,

however, the disruption of Gondwanaland never occurred, the Peninsula of India would have remained embedded in a continent and would, consequently, have had no coasts; there would have been no European invasions by sea and the whole history of the country for the last few centuries would have been profoundly different.

As another instance of the manner in which the existence of the sea has reacted upon the history of India, attention may be drawn to the eastern festoon constituted by the Tertiary mountain ranges of Assam and Arakan. Had their continuation through the Andaman and Nicobar Islands to Sumatra and Java not been breached, these ranges would have acted as a barrier between India and Burma almost as effective as that between Tibet and India provided by the Himalayan ranges. The mere fact that the events of geological history have caused this range to be discontinuous with the isolation of the Andaman and Nicobar Islands and the provision of the sea passage from India to what is now Rangoon, led in an inevitable manner to the addition of Burma to the Indian Empire.

Directing our attention once again to India we find we have here a country of the size of Europe without Russia, containing at least as many different races with at least as great a diversity as in Europe. India is fortunate, however, in that the general geological conditions have caused the inhabitants, in spite of their diversity of race, religion and language, to be welded, after struggles through the ages, into one political unit. As with national boundaries in Central Europe, the boundaries between the provinces in India pay little attention in many cases to geological considerations. The province of Bihar and Orissa, for instance, in which we are now meeting, is an excellent example of the violation of natural principles by provincial boundaries. But as long as a central political control remains, it does not matter seriously that the boundaries between our provinces take such little account of natural factors. Were the central control, however, removed and all political relationship to one general suzerain power severed, then the future history of India would again become as confused as it was in the past and as confused as that of Central Europe has been throughout the ages and promises to become again in the future.

I have suggested in the short time at my disposal the profound influence upon the history of a nation and upon the determination

of its boundaries that may be exerted by geological factors, how relative national stability appears to be attained in cases where natural boundaries are based on physical features, and how the history of a country in respect of its extent and government appears to become confused and doubtful in cases where national boundaries have been laid down in defiance of physical considerations.

Leaving the general for the particular, I propose now to point to a few precise events and sets of conditions in India that can be ascribed to particular events in the geological history of the country.

DELHI CITY'S STRATEGIC POSITION

In the first place we may refer to the position of the capital. There is no doubt that the defence of any country is one of prime importance, and that, therefore, the position of great internal strategic importance may have claims for selection as the capital of the country. A glance at this map will show you that Delhi, by virtue of its position at the apex of the Peninsula, occupies the most strategic point in India, with reference to the internal peace of the country. For Delhi is at the point where the plains of the Indo-Gangetic alluvium that separate the Peninsula from the Himalayas become most constricted, the point consequently at which it is easiest to defend the fertile plains of the Jumna and the Ganges to the east against invasion from the west, the direction from which most of the major external invasions of the past have come. It is not surprising, therefore, that in the past history of India there have been three decisive battles at Panipat in the plains north of Delhi. It is this position at the apex of the Peninsula that caused Delhi to be the capital home of the Moghal Emperors and their predecessors, and which really caused the removal of the capital of India in recent times from Calcutta to Delhi.

But the welfare of a country does not depend only upon defence and politics. Commerce and industry are also of vital importance and, in so far as they are the true sources of wealth to a country, their importance may transcend military and political factors. It will be seen that a point somewhere in the delta of Bengal, by its connection with the Hinterland of the Gangetic valley and the highlands of Assam, its sea connection to Burma and Southern India, and its proximity to the coal-fields of Bengal,

Bihar and Orissa, seems to be a natural site for a commercial and industrial capital; *it is because of the existence of these underlying* natural factors that Calcutta continues to be the commercial capital of India, in spite of the removal of the political capital to Delhi.

The *ultimate* factors that have caused the selection of Delhi as the political capital of the Indian Empire with the *de facto* retention of Calcutta as the commercial capital date back to the series of events that caused the break-up of Gondwanaland, followed by the elevation of the Himalayas and the deposition of the alluvium of the Indus, the Ganges, and the Brahmaputra.

Another important item in the sequence of events following the break-up of Gondwanaland was the eruption of the Deccan Traps that cover some 200,000 square miles of Western India. For it is the eruption of these lava flows that is the real cause of the greatness of Bombay. Bombay depends mainly upon the cotton industry, and the latter is dependent upon the fertility of the black cotton soil derived mainly from these lavas. The foundations of Bombay were, in fact, laid, when the Deccan Traps were poured forth, let us say, 75 million years ago.

Other events in the modern history of India can, however, be attributed to dates much more ancient than this; for example, the institution of the iron and steel industry at Jamshedpur in this province. This industry is dependent for its supplies of iron-ore and limestone upon deposits that were laid down in Archaean times, and upon deposits of coal laid down in early Gondwana times. We may ascribe an antiquity to these deposits of iron-ore and limestone of something between 600 million and a thousand million years, and to the coal an antiquity of some 200 million years. The foundations of the iron and steel industry at Jamshedpur were thus laid down at periods ranging from, say, 750 to 200 million years ago.

Numerous other examples could be cited of the dependence of particular events or industries upon past events in the geological history of India; but time does not permit.

The examples given all illustrate the manner in which geology has affected man, without his being conscious thereof: they illustrate the action of cause and effect in which mankind appears as the helpless child of geology.

UTILITARIAN SIDE OF GEOLOGY

There is, however, another aspect of our subject in which man derives conscious benefit from his geological heritage by utilising the rocks, minerals and structures now lying at or near the surface of the globe. This may be described as the utilitarian side of geology. On the utilitarian side geology helps not only in the development of mining and metallurgical industries, but also in many branches of engineering, both in the provision of materials and in structural problems dependent upon the strength and disposition of rocks such as those connected with foundations, with the study of landslips and earthquakes, and with the alignment of railways. Further, as a result of the development of mineral and metallurgical industries, geology becomes the cause not only of revenue to Government in the shape of income-tax and royalties, but also of the creation of a widening circle of employment, starting from employment to miners and smelters and spreading out to employment for the great transporting agencies the railways and shipping companies, to mention only a few of the interests that benefit.

But should the conscious use of geology by man be confined to these directly utilitarian but relatively minor purposes? Should not man as a result of his studies of the trend and influence of geological factors on a large scale, attempt so to adjust national and international life to these factors as to help the growth of national welfare and international peace, instead of, as so often happens, pursuing, in indifference to these natural factors, courses of action that tend to increase national or international disequilibrium?

It is mainly for utilitarian reasons, however, and partly, perhaps, because in addition it is realised that a country should know herself, that every civilised country maintains a Geological Survey Department for the purpose of ascertaining the factors upon which so much appears to depend.

Neglect to use Geography

Major Mason's Warning

Major Kenneth Mason, the first Professor of Geography in the University of Oxford, delivered his inaugural lecture recently on "The Geography of Current Affairs." The president of the Royal Geographical Society (Admiral Sir W. E. Goodenough) and Sir H. Mackinder were among his audience.

He defined geography as the study of the earth as the home of man. The object of the Oxford School, therefore, should be to give a sound framework of geographical knowledge, properly fitted together by the study of geographical facts on which to base our behaviour in the world. History and geography were kindred subjects. As the historian concerned himself primarily with what had happened to Man since the dawn of history, so the geographer should first concern himself with the stage upon which Man had acted. The present had always been the most important moment in geography. An event like the cutting of the Suez Canal profoundly altered the whole geography of the East. The conquest of the air set new problems to be solved with the specialized aid of the meteorologist and the physiologist.

Most if not all of the problems of the present had a definite geographical aspect. Japan's action in Manchuria was determined by her proximity to a mainland abounding in the fuel, raw material and undeveloped arable land denied to the mountainous, over-populated islands. Neglect to use geographical experience by omitting to repair the banks of the Yangtze was largely responsible for the recent Chinese famines. The future prosperity of a large agricultural population in India was bound up with the maintenance of artificial irrigation works. Idealism would not solve these problems, which required the close study of hard facts.

Oxford was quick to recognise this in the past. The first lectureship in any British University was founded as long ago as 1541 for Baldwin Norton. Thirty years later Richard Hakluyt, the

leading geographer of his age took his degree. After a certain eclipse in the nineteenth century the Royal Geographical Society enabled the University to organise the teaching anew under the guidance of Sir H. Mackinder.

It was the facts about geography that were required rather than unverified theories. Geographers must co-operate with their relatives in science. If the pioneer's day was nearly over, the specialist-explorer's dawn was only breaking. For, though the world was discovered, scarcely a hundredth part of its land surface was properly surveyed. Administrators hardly recognised how extraordinarily valuable to them a scientific map would be. The Geographical Department of the India Office in the last century under Sir Clements Markham co-ordinated their results for the great benefit of the Secretary of State. Scientific work must show a continuous activity to cope with the continuous problem of an ever-increasing world population.

History was not governed by geography, but history was made by the use of geography, intelligent or otherwise. Geography was every day becoming more and more international. It was essential that geographers of all nations should speak the truth and speak it clearly.

The Ideal Holiday

By

MARGARET MACALISTER.

Cruising, camping, cycle, motor, caravan, the seaside sojourn: from what these offer I would turn, shoulder my pack, and once again take my holiday afoot.

I do not use the word "hike". It is overdone and may be misleading. I do not fear exertion and can face rain and wind without undue murmuring, but neither do I despise comfort. After improvised meals in the heather, I prefer at the close of day to be served with a supper I have not cooked, and to sleep in a bed (with sheets) which I need not make.

The walker is bound to no high road. He can explore a wood, ford a stream, cross a moor or scale a mountain. He has no parking worries, no engine troubles, no tyre disasters. His knapsack holds a week's needs, not forgetting books, to supplement the intellectual fare of country inns. A travelling suit-case can be met or overtaken. There is no need for the discomfort of slovenliness.

And the road? I have walked over England from the Roman Wall to Land's End and, in Scotland, glens and hills innumerable. From all memory's pageant I choose the Isle of Skye. Here are glens and corries which no motor-cycle can traverse.

June for choice, with its long days and clear nights. The heather is crisp and green. The whin glows with gold. From every hill-top, fairy isles are seen.

> "O to mount again where erst I haunted;
> Where the red old hills are bird-enchanted."

Next year, perhaps?

—From "The Bookman", September 1932.

News and Notes

With this number, the journal completes its 7th volume. It will be noted that the issues of this volume have not only been nearly doubled in size, but have been considerably improved otherwise by Lino-type printing, finer get-up, etc. We have no doubt that the general appreciation of the improved quality of the Journal will result in the coming year in increasing the number of subscribers to it, thereby enabling the extra cost to be met without a deficit.

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Members who have not yet paid their subscription for the current year are requested to remit it early. Those who are in arrears are informed that their names will not be included in the new year's list till the dues are paid off.

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We are glad to note that the office which has recently been furnished and equipped, is now visited by members in larger numbers who come to consult the books, exchange journals, O. S. maps, etc.

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The Working Council of the Association has thankfully received from the Rt. Hon'ble V. S. Srinivasa Sastri the present of a dozen volumes of books and note-books on geology, belonging to his relative, the late talented overseas research scholar in Geography, Mr. M. S. Subrahmaniam.

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Special studies of the Districts of Coimbatore, Malabar, Madura, and Ramnad are available in the shape of the three Special Numbers of the Journal, which contain all the papers read at the first three Geographical Conferences held at Coimbatore, Palghat and Madura. It is hoped that educational institutions in these and other districts will go in for these special issues which are practically source books, containing articles by specialists on various aspects of their Geography.

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The S. S. L. C. syllabus in Geography—along with Hints and Comments thereon by Mr. N. Subrahmanyam, which appeared in back numbers of the Journal, has been published as a Pamphlet which can be had from the Secretary at annas four each (postage extra).

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Under the auspices of the Kistna District Teachers' Guild a short Refresher Course in Geography was conducted by the Secretary of the Association at Masulipatam during Christmas week. It was the first of its kind in the District and was valued highly by the teachers who attended the course.

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Under the joint auspices of the Madras Geographical Association and the Geography Section of the Madras Teachers' Guild an excursion was conducted in the latter part of the Christmas holidays to Nagari Hills, the Nagari Bugga (Spring), Kailasanatha Konai (Waterfall) and Karvetnagar. The party, which was led by Mr. N. Subrahmanyam, the Secretary, consisted of 15 teachers; and the trip was made by bus all the way. After an interval of three weeks, a second excursion to the Nagari Hills, including the Spring and the Waterfall, was again conducted by him; and this time the party consisted of 30 persons—mostly students of the University Diploma Course, along with their lecturers. Karvetnagar was now dropped out of the programme; but the shale-beds of Sriperumbudur was visited on this occasion. Some typical views of the Hill, the Spring, the Waterfall, etc., were snapped and the students were shown and explained some of the interesting geological and geographical features in their natural setting. A descriptive account of the excursion with the views taken will be published in the next number of the Journal.

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An ordinary meeting of the Association was held at 4-30 p.m. on Saturday the 28th January 1933 in the Presidency College with Dr. H. Gravely in the chair when *Mr. V. Rangacharya,* Professor of Indian History in that College, read the first part of a paper on *The History of South Madras.* He was able to cover the general introduction and the History of Adyar and Teynampet only. In a series of about half a dozen lectures, he expects to cover the history of the rest of Madras, which will be published serially in the Journal.

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Miss G. E. Benham, who is on her 7th world tour, gave a talk to the members of the Association on 1-2-1933 on *My Tramps in the Himalayas* and exhibited views of Himalayan scenes sketched by her. She also gave talks in several educational institutions in the city on her various travel experiences in different parts of the world.

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The Vizagapatam branch of the Association held four meetings in November and December 1932, in which the following four lectures were delivered:

1. *The Geographical Interpretation of History* by Mr. G. Venkat Rao, M.A., LL.B. (4—11—'32).

2. *Some Aspects of the Urban Geography of South India* by Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S. (3—12—'32).

3. *Economic Resources of Andhra Desa and their Industrial Development* by Mr. V. Y. Sarma, M.A., L.T. (4—12—'32), and

4. *Vizagapatam Harbour* by Mr. W. C. Ash, Engineer-in-Chief of the Vizagapatam Harbour (15—12—'32).

The last meeting which was presided over by Sir J. C. Coyajee was a splendid success, being attended by an audience of over 300 persons, including the District Officers and the Harbour staff. Mr. Ash illustrated his lecture with specially prepared plans of the Harbour and with several slides on Vizagapatam and Durban Harbours. The whole paper will be published in the next number of the Journal.

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Members of the Association are requested to attend the next Geographical Conference at Trichinopoly in May next.

It is intended to arrange for an excursion to Pachaimalai Hills after the Conference is over.

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Under the joint auspices of the XXVth Educational Conference and of the Madras Geographical Association, a Refresher Course in Geography will be held at Trichinopoly during May next. Attention is drawn to the appended prospectus for further details about it.

Reviews

நூதன முறை சித்திரபூகோளம், ஆரம்ப பூகோளம்.

(Illustrated Geography on new lines, Beginners' Book) by M. Krishnamurti (The Central Publishing Bureau, Ltd.), Price As. 4.

Unlike the ordinary Elementary text-books in Geography in common use in South India at present which treat the subject logically and systematically from the adults' point of view, this little book is an attempt to produce a children's Geography book on quite modern lines from the children's point of view leading them out from their immediate environment to far off lands by means of short descriptive accounts.

The book is illustrated with typical pictures, and suggestive exercises have been included at the end of each chapter. We wish that more such books are written in the South Indian Vernaculars along modern lines.

A Junior History of India by Prof. V. Rangacharya, M.A. (The Indian Publishing House, Ltd.), Price Rs. 2.

We have nothing but praise for this sumptuous little volume written by a master of the subject for use in South Indian High Schools according to the revised S. S. L. C. syllabus. The subject is treated in a clear and interesting manner and the book is illustrated profusely with maps, portraits, pictures, coins, etc. Special mention may be made of the geographic correlation that is an evidence throughout as well as of the geographic introduction in the opening chapter. The divorce of the geographic basis of history especially in the teaching of the subject deprives it of half its value and interest, and the author has not forgotten the importance of this truth. The book, which is a marvel of cheapness, is also well got up.

A History of England by L. C. Brandon (The Indian Publishing House, Ltd.), Price Rs. 2.

The book presents a clear narrative of the History of England in outline without complicating the subject or exhibiting an array of names, dates and events which are relegated to the appendix for reference. It is written in accordance with the revised S. S. L. C. Syllabus of the Madras Educational Department, and is illustrated copiously with maps, pictures, monuments, etc. The fine paper, bold print and neat get-up make the volume attractive; while the price has at the same time been kept very low,

Books and Journals Received

Illustrated Geography on Modern Lines: Beginners' Book by M. Krishnamurthi (The Teachers' Central Publishing Bureau, Ltd.).

A Junior History of India by Prof. V. Rangacharya (The Indian Publishing House, Ltd.).

A History of England by L. C. Brandon (The Indian Publishing House, Ltd.).

Report on the Operations of the Department of Agriculture, Madras Presidency, for 1931-32.

Tirumalai Sri Venkateswara—November and December 1932 and January 1933.

Ganga—November and December 1932.

Proceedings of the Royal Geographical Society, South Australian Branch, for 1930-31, Volume XXXII.

The Geographical Journal—November and December 1932 and January 1933.

The South Indian Teacher—November and December 1932 and January 1933.

The Indian Educator—October and November 1932.

The Educational Review—November and December 1932 and January 1933.

The Quarterly Journal of the Mythic Society—October 1932.

Report of the Department of Industries, Madras, 1931-32.

Kalaimagal—November and December 1932 and January 1933.

Geography—December 1932.

Wealth and Welfare—from 30-12-'32 to 13-1-'33.

Mitteilungen der Gesellschaft Fur Erdkunde zu Leipzig—1930-31.

Journal of the Andhra Historical Research Society—October 1932.

The Geographical Review—January 1933.

Refresher Course in Geography

May 1933

Under the joint auspices of the 25th Provincial Educational Conference and the Madras Geographical Association, a refresher course in Geography will be conducted for about two weeks in May next at Trichinopoly. It is primarily intended to give training in Practical Geography to teachers handling the subject in Secondary and Training Schools.

The course will consist mainly of practical work, field work and excursions, and will present the salient point, in such essential matters as map-making, map-reading and map-correlations, the study of land forms, climate and weather, use of graphic methods and statistics, and construction of diagrams, models and appliances.

It is expected that Principals, Headmasters and managements will, in the interests of efficiency of Geography teaching in their institutions, provide all the necessary facilities for their Geography teachers to come to Trichinopoly and undergo the course. The number proposed to be trained is 60.

Applications are invited, and such of the applicants as are selected will be furnished with other details regarding the course. Applications should be addressed to :—

THE SECRETARY,
The Madras Geographical Association,
Gopalapuram, Cathedral Post (Madras).

so as to reach him not later than the 10th March, 1933.

A fee of Rs. 10 will be charged for the entire course. This amount should be remitted to the Secretary, after receipt of the intimation of selection, so as to reach him not later than 10th April 1933. Those whose fees are not received by that date cannot have their seats guaranteed.

Lodging and Boarding for those that require it will be arranged in one of the hostels and the probable expenses will be about Rs. 10 for the whole period, payable in advance. Those wishing to stay in the hostel will remit in advance this amount also to the Secretary.

Madras,
12th February, 1933.

N. SUBRAHMANYAM,
Secretary.

PAPERS READ AT THE THIRD GEOGRAPHICAL

CONFERENCE AT MADURA, MAY 1932

1. *Presidential Address—Meteorology of Madura:* By Dr. A. L. Narayana, M.A., D.Sc.

2. *The Physical Geography of the Madura District:* By Mr. T. N. Muthusami, M.A., L.T.

3. *The Sub-Regions of the Madura District:* By Mr. G. Narayanasami, M.A., L.T.

4. *The Forests of the Madura District:* By Mr. W. C. Hart.

5. *The Hill Produce of Madura:* By Mr. K. C. Ramakrishnan, M.A.

6. *The Fauna of Madura and Ramnad Districts:* By Mr. C. P. Gnanamuthu, M.A., F.Z.S.

7. *A Note on the Fishing Industry of the Ramnad District:* By Dr. D. W. Devanesan, M.A., Ph.D., D.I.C.

8. *Cotton Growing in Madura-Ramnad:* By Mr. S. V. Duraiswami Ayyar, B.A., B.Sc. (Ag.).

9. *A Brief Survey of Economic Geography:* By Prof. A. J. Saunders, M.A., Ph.D.

10. *The Economic Conditions and Possibilities of Pandya Nad:* By Mr. C. A. Krishnamurthi Rao, M.A., F.R. Econ. S.

11. *Fairs and Trade Centres of Madura and Ramnad:* By Mr. V. Krishnan, B.A. (Hons.), Dip. Econ.

12. *A Note on the Communication Lines of Madura and Ramnad Districts:* By Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S.

13. *Urban Geography of Madura:* By Mr. R. Dann.

14. *Place Names in Pandinad:* By Mr. S. Somasundara Bharathi, B.A., B.L.

15. *Human Geography of the Ramnad District:* By Mr. J. S. Ponniah, M.A.

16. *The Kumbam Valley:* By Mr. P. S. Ramaswami Ayyangar, B.A., L.T.

17. *Limits of the Pandyan Kingdom:* By Mr. Rao Sahib C. M. Ramachandra Chettiar, B.A., B.L.

18. *Why Tamil Became so well Developed at Madura:* By Mr. Rao Sahib C. M. Ramachandra Chettiar B.A., B.L.

19. *Agricultural Geography of Madura:* By Mr. A. S. Rajamanikkam, M.A.

PAPERS READ AT THE FIRST GEOGRAPHICAL CONFERENCE AT COIMBATORE

1. *Geographical Control of Early Kongu History:* By Mr. P. T. Srinivasa Iyengar, M.A.

2. *The Geographical Limits of Kongunadu at various epochs:* By Mr. C. M. Ramachandra Chettiar, B.A., B.L.

3. *A Survey of the Recent History of Coimbatore District:* By Mr. C. S. Srinivasa Chariar, M.A.

4. *Some Place-names of Coimbatore District:* (i) By Mr. S. Natesan, B.A. (Hons.), L.T., (ii) By Mr. C. M. Ramachandra Chettiar, B.A., B.L.

5. *A Note on the Physical Geography and Geology of Coimbatore District:* By Mr. T. N. Muthuswami, M.A., L.T.

6. *Meteorology of Coimbatore District:* By Mr. M. S. Subramaniam, B.A. (Hons.).

7. *Agricultural Geography of Coimbatore District* (with special reference to garden crops): By Mr. K. C. Ramakrishnan, B.A.

8. *Cattle of Kongunad:* By Mr. A. Swaminatha Ayyar, B.A.

9. *Home Industries of Coimbatore District:* By Mr. R. Hari Rao, M.A., L.T.

10. *Mill Industry of Coimbatore District:* By Mr. C. V. Venkataramana Ayyangar, B.A., B.L.

11. *Population of Coimbatore District:* By Mr. S. S. Krishnaswami, B.A., L.T.

12. *A Note on the Urban Geography of Coimbatore:* By Mr. R. Dann.

13. *Towns-sites and Communications-lines of Coimbatore District:* By Mr. N. Subrahmanyam, M.A., L.T.

14. *Public Health of Coimbatore District in relation to physical conditions:* By Major A. M. V. Hesterlow, I.M.S.

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